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(71)出願人　000113263
ホーヤ株式会社
東京都新宿区中落合２丁目７番５号
(72)発明者　畑　光明
東京都新宿区中落合２丁目７番５号　ホーヤ株式会社内
(74)代理人　100091362
弁理士　阿仁屋　節雄　（外２名）

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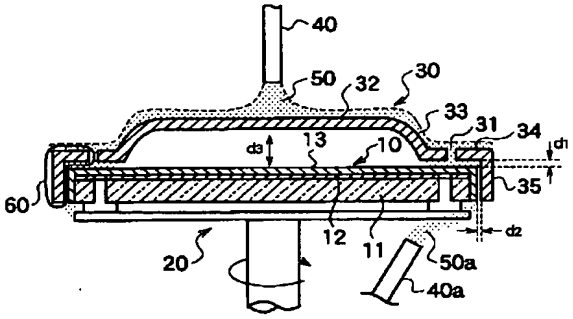
(54)【発明の名称】　不要膜除去方法及びその装置並びにフォトマスクブランク製造方法

(57)【要約】
【課題】　処理中に基板表面に形成された膜に悪影響を及ぼす可能性のある温度分布を与えることなく不要膜を確実に除去できるようにする。
【解決手段】　基板表面に形成された膜のうちの不要な部分を溶媒によって溶解除去する不要膜除去方法であって、基板１０の表面をカバー部材３０で覆い、このカバー部材３０の上から溶媒５０を供給してこの溶媒５０をカバー部材３０の所定部位に設けられた溶媒供給孔３１を通じて不要な膜部分を溶媒で溶解して除去するとともに、基板１０の表面の不要な膜部分以外の領域においてはカバー部材１０の内壁と基板１０表面との間の間隙を、基板１０の表面の膜の温度分布がカバー部材３０からの熱伝達によって影響を受けないように所定以上大きく設定した。



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【特許請求の範囲】

【請求項１】　基板表面に形成された膜のうちの不要な部分を溶媒によって溶解除去する不要膜除去方法であって、

前記基板表面をカバー部材で覆い、このカバー部材の上から溶媒を供給してこの溶媒をカバー部材の所定部位に設けられた溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去するとともに、

前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさに設定したことを特徴とする不要膜除去方法。

【請求項２】　基板表面に形成された膜のうちの不要な部分を溶媒によって溶解除去する不要膜除去方法であって、

前記基板表面をカバー部材で覆い、このカバー部材の上から溶媒を供給してこの溶媒をカバー部材の所定部位に設けられた溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去するとともに、

前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさであって、かつ、前記間隙で気体の対流が生じてこの対流によって基板主表面の膜に温度分布が生じない大きさに設定したことを特徴とする不要膜除去方法。

【請求項３】　前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙の大きさを一定にしたことを特徴とする請求項１又は２に記載の不要膜除去方法。

【請求項４】　前記基板表面の不要な膜部分の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、この間隙に溶媒を供給したとき溶媒が間隙中をつたわって間隙中に拡がることが可能な大きさに設定したことを特徴とする請求項１ないし３のいずれかに記載の不要膜除去方法。

【請求項５】　前記基板表面の不要な膜部分の領域において、前記カバー部材内壁と前記基板表面との間の間隙の大きさを設定する間隙設定部材として、前記カバー部材内壁と前記基板表面との間に介在される所定の太さの紐状体を用いるようにしたことを特徴とする請求項１ないし４のいずれかに記載の不要膜除去方法。

【請求項６】　前記基板及びカバー部材をともに回転させながら溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去することを特徴とする 請求項１ないし５のいずれかに記載の不要膜除去方法。

【請求項７】　前記溶媒は、カバー部材の上から供給するのに加えて、基板の裏面側からも不要な膜部分の領域に向けて供給するようにしたことを特徴とする請求項１

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ないし６のいずれかに記載の不要膜除去方法。

【請求項８】　基板表面に形成された膜のうちの不要な部分を溶媒によって溶解除去する不要膜除去装置であって、

前記基板表面を覆うカバー部材と、

このカバー部材の上から溶媒を供給する溶媒供給装置とを有し、

前記カバー部材は、前記溶媒供給装置によって供給された溶媒を不要な膜部分に供給して不要膜を溶解除去する溶媒供給孔を有し、かつ、前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさであって、かつ、前記間隙で気体の対流が生じてこの対流によって基板主表面の膜に温度分布が生じない大きさにしたものであることを特徴とする不要膜除去装置。

【請求項９】　前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙の大きさを一定にしたことを特徴とする請求項８に記載の不要膜除去装置。

【請求項１０】　前記基板表面の不要な膜部分の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、この間隙に溶媒を供給したとき溶媒が間隙中をつたわって間隙中に拡がることが可能な大きさに設定したことを特徴とする請求項８又は９に記載の不要膜除去装置。

【請求項１１】　透光性基板に遮光膜等の膜を形成する膜形成工程を有するフォトマスクブランク製造方法において、

前記膜形成工程において不要な部分に形成された不要膜を請求項１ないし７のいずれかに記載の方法で除去する不要膜除去工程を有することを特徴とするフォトマスクブランク製造方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、例えば、フォトマスクブランク、半導体基板、磁気ディスク基板及びカラーフィルター等の基板表面の一部に形成された不要膜を除去する不要膜除去方法及びその装置並びにフォトマスブランクスの製造方法に関する。

【従来の技術】

【０００２】半導体装置、フォトマスク、磁気ディスク基板、カラーフィルター等を製造する分野においては、基板の一主表面に形成された塗布膜その他の膜のうちの不要な一部分を除去することがしばしば要求される。

例えば、基板上にレジストあるいはＳＯＧ（スピン・オン・グラス）膜等を塗布する際に、略水平に保持した基板上に塗布液を滴下しつつ基板を回転することによりその遠心力を利用して基板上に均一な塗布膜を形成するス

ピンコート法を用いた場合、塗布膜が基板の全面に均一に形成させるような低速で回転させると、基板表面の周縁部に働く遠心力が小さくなり、塗布液が基板表面の周縁部に溜まり、その部分の膜厚が厚くなってしまう。

【０００３】このように、基板表面の周縁部が盛り上がると、例えば塗布液がＳＯＧの場合は、その部分にクラックが入りやすくなる。また、ＳＯＧが基板表面の周縁部に形成されている位相シフトマスクを露光装置に取り付けるときに、基板周縁部を支持する構造となっている場合があるが、この場合に基板周辺部が盛り上がっていると良好に保持されないことになる。さらに、塗布液がレジストの場合は例えばフォトマスクを重ねて密着露光を行う際に、フォトマスクとレジスト塗布膜とが良好に密着されないという問題が生ずる。したがって、このような場合には基板表面周縁部の不要な塗布膜を除去する必要がある。

【０００４】このような不要な膜を除去する従来技術として、特公昭５８－１９３５０号公報、特開平６－２６２１２４号公報、特開平７－２０６２３号公報等に開示されている方法がある。特公昭５８－１９３５０号公報に開示の方法は、基板を、その表面を上向きにターンテーブルに載置して回転し、下方からノズルによって溶媒を噴射させたりあるいは、基板表面に中空のピラミッド形状をなしたカバーを配置し、ピラミッドの頂点の上から溶媒を供給して周縁部に供給するようにしたものである。

【０００５】また、特開平６－２６２１２４号公報に開示の方法は、処理液を供給すべき部位の基板表面と間隙形成部材との間の間隙を所定の間隙にして処理液がその部位に確実に供給されるようにしたものである。さらに、特開平７－２０６２３号公報に開示の方法は、カバー部材に設けられた気体導入口から気体を供給し、溶媒が基板中心部に侵入するのを防止したものである。

【０００６】

【発明が解決しようとする課題】ところで、例えば、基板表面に形成された膜がレジスト膜の場合には、レジスト膜材料の種類によっては、レジストに加えられた温度履歴が露光感度に敏感に影響するものもある。このようなレジスト膜の場合には、温度履歴が膜の場所によって異なる場合には露光感度ムラが生ずることになる。それゆえ、上述の不要膜除去方法を実施する場合に、例えば、溶媒の気化熱等が影響してレジスト膜に温度分布が生ずるような環境で処理すると露光感度ムラを与えてしまうことになる。しかるに、上述の従来の方法は、いずれも、このような懸念に対して必ずしも十分に配慮されたものではなかった。

【０００７】本発明は上記問題点を解決するためになされたものであり、処理中に基板表面に形成された膜に悪影響を及ぼす可能性のある温度分布を与えることなく不要膜を確実に除去できる不要膜除去方法及びその装置並びにフォトマスクブランク製造方法を提供することを目的としたものである。

【０００８】

【課題を解決するための手段】上述の課題を解決するために、第１の手段は、基板表面に形成された膜のうちの不要な部分を溶媒によって溶解除去する不要膜除去方法であって、前記基板表面をカバー部材で覆い、このカバー部材の上から溶媒を供給してこの溶媒をカバー部材の所定部位に設けられた溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去するとともに、前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさに設定したことを特徴とする不要膜除去方法である。第２の手段は、基板表面に形成された膜のうちの不要な部分を溶媒によって溶解除去する不要膜除去方法であって、前記基板表面をカバー部材で覆い、このカバー部材の上から溶媒を供給してこの溶媒をカバー部材の所定部位に設けられた溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去するとともに、前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさであって、かつ、前記間隙で気体の対流が生じてこの対流によって基板主表面の膜に温度分布が生じない大きさに設定したことを特徴とする不要膜除去方法である。第３の手段は、前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙の大きさを一定にしたことを特徴とする第１又は第２の手段にかかる不要膜除去方法である。第４の手段は、前記基板表面の不要な膜部分の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、この間隙に溶媒を供給したとき溶媒が間隙中をつたわって間隙中に拡がることが可能な大きさに設定したことを特徴とする第１ないし第３の手段にかかる不要膜除去方法である。第５の手段は、前記基板表面の不要な膜部分の領域において、前記カバー部材内壁と前記基板表面との間の間隙の大きさを設定する間隙設定部材として、前記カバー部材内壁と前記基板表面との間に介在される所定の太さの紐状体を用いるようにしたことを特徴とする第１ないし第４のいずれかの手段にかかる不要膜除去方法である。第６の手段は、前記基板及びカバー部材をともに回転させながら溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去することを特徴とする 第１ないし第５のいずれかの手段にかかる不要膜除去方法である。第７の手段は、前記溶媒は、カバー部材の上から供給するのに加えて、基板の裏面側からも不要な膜部分の領域に向けて供給するようにしたことを特徴とする第１ないし第６のいずれかの手段にかかる不要膜除去方法である。第８の手段は、基板表面に形成された

膜のうちの不要な部分を溶媒によって溶解除去する不要膜除去装置であって、前記基板表面を覆うカバー部材と、このカバー部材の上から溶媒を供給する溶媒供給装置とを有し、前記カバー部材は、前記溶媒供給装置によって供給された溶媒を不要な膜部分に供給して不要膜を溶解除去する溶媒供給孔を有し、かつ、前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさであって、かつ、前記間隙で気体の対流が生じてこの対流によって基板主表面の膜に温度分布が生じない大きさにしたものであることを特徴とする不要膜除去装置である。第９の手段は、前記基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙の大きさを一定にしたことを特徴とする第７の手段にかかる不要膜除去装置である。第１０の手段は、前記基板表面の不要な膜部分の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、この間隙に溶媒を供給したとき溶媒が間隙中をつたわって間隙中に拡がることが可能な大きさに設定したことを特徴とする第８又は第９の手段にかかる不要膜除去装置である。第１１の手段は、透光性基板に遮光膜等の膜を形成する膜形成工程を有するフォトマスクブランク製造方法において、前記膜形成工程において不要な部分に形成された不要膜を第１ないし第７のいずれかの手段にかかる方法で除去する不要膜除去工程を有することを特徴とするフォトマスクブランク製造方法である。

【０００９】上述の第１の手段によれば、基板表面（主表面のみならず側面及び裏面も含む）の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさに設定したことにより、処理中に基板表面に形成されたカバー部材からの熱伝達によって膜に悪影響を及ぼす可能性のある温度分布を与えることなく不要膜を除去できる。また、これにより、仮に、カバー部材表面に溶媒の気化熱等が不均一に作用して温度分布が生じたとしても、その影響が基板表面の膜に及んでその膜に温度ムラを付与するようなおそれも防止できる。したがって、例えば、上記膜が場所ごとに熱処理履歴が違うと感度ムラが生じてしまうようなレジスト膜である場合にも、有害な感度ムラを与えてしまうおそれを効果的に防止できる。さらには、カバー部材として、表面の温度ムラが内壁に到達しないようにするための特別な配慮をした部材を用いる等の必要性をなくすこともできる。第２の手段によれば、基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさであって、かつ、前記間隙で気体の対流が生じてこの対流によって基板主表面の膜に温度分布が生じない大きさに設定したことにより、処理中に基板表面に形成された膜に悪影響を及ぼす可能性のある温度分布付与の可能性をより効果的に防ぎながら不要膜を除去できる。第３の手段によれば、基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙の大きさを一定にしたことにより、処理中に基板表面に形成された膜に悪影響を及ぼす可能性のある温度分布付与の可能性をさらに効果的に防ぎながら不要膜を除去できる。第４の手段によれば、前記基板表面の不要な膜部分の領域においては前記カバー部材の内壁と前記基板表面との間の間隙を、この間隙に溶媒を供給したとき溶媒がその表面張力の作用等により間隙中をつたわって間隙中に拡がることが可能な大きさに設定したことにより、例えば、周縁平坦部の幅自体を除去幅とすること等も可能となるなど、溶媒供給孔から供給された溶媒を確実かつ正確に不要な膜部分に供給してこれを除去できる。第５の手段によれば、前記基板表面の不要な膜部分の領域において、前記カバー部材内壁と前記基板表面との間の間隙の大きさを設定する間隙設定部材として、前記カバー部材内壁と前記基板表面との間に介在される所定の太さの紐状体を用いるようにしたことにより、間隙中に溶媒を流通させるために特別な装置等を設けることなく、極めて簡単に、所定の大きさの間隙を形成することができる。第６の手段によれば、前記基板及びカバー部材をともに回転させながら溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去するようにしたことにより、遠心力等の作用を利用して、溶媒を均等に広げてより容易・確実に不要な膜部分に供給することができる。第７の手段によれば、溶媒をカバー部材の上から供給するのに加えて基板の裏面側からも不要な膜部分の領域に向けて供給するようにしたことにより、より確実に不要膜を除去することが可能になる。なお、裏面側から供給するタイミングは、カバー部材の上から供給する溶媒供給のタイミングに対して先でもよいし、同時でもよいし、後でもよいし、あるいは、間欠的でもよい。第８の手段によれば、第１及び第２の手段にかかる方法を実施できる装置を得ることができる。第９の手段によれば、基板表面の不要な膜部分以外の領域においては前記カバー部材の内壁と前記基板表面との間の間隙の大きさを一定にしたことにより、処理中に基板表面に形成された膜に悪影響を及ぼす可能性のある温度分布付与の可能性をさらに効果的に防ぎながら不要膜を除去できる。第１０の手段によれば、除去したい不要膜部分をより正確に除去できる装置を得ることができる。第１１の手段によれば、不要膜を正確にかつ容易・確実に除去することができるフォトマスクブランク製造方法を得ることができる。

【００１０】

【発明の実施の形態】図１は本発明の実施例にかかる不

要膜除去装置の構成を示す断面図、図２及び図３は図１の部分拡大断面図、図４は実施例にかかる不要膜除去装置の部分拡大斜視図、図５は実施例にかかる不要膜除去装置の分解斜視図である。以下、これらの図面を参照にしながら実施例にかかる不要膜除去方法及びその装置並びにフォトマスクブランク製造方法を説明する。以下の説明では、まず、不要膜が形成されたフォトマスクブランクを説明し、次に、不要膜除去装置の構成を説明し、最後に不要膜除去方法と併せてフォトマスクブランク製造方法を説明する。

【００１１】図１ないし図５において、基板１０は、合成石英ガラスからなる透明基板（６インチ×６インチ×０．２５インチ）１１の表面にクロムからなる遮光膜１２が形成され、さらに、この遮光膜１２の上に厚さ４０００オングストロームの未ベークの状態のレジスト膜（チッソ株式会社製ＰＢＳＣ）１３がスピンコート法等で形成された（図３，図４参照）フォトマスクブランクである。

【００１２】ここで、このレジスト膜１３は、本来、基板１１の表面の主要部にのみ形成されていればよい。しかしながら、レジスト膜１３の形成の際に、本来形成する必要のない基板１１の表面の周縁部、基板側面部及び場合によっては基板裏面部にまで形成されてしまう。この実施例にかかる不要膜除去方法及びその装置は、これらの不要膜を除去する方法及び装置である。

【００１３】この実施例の不要膜除去装置は、図１に示されるように、回転台２０に載置保持された基板１０の上面側をカバー部材３０によって覆い、このカバー部材３０の上方からノズル４０よりＭＣＡ（メチルセロソルブアセテート）等の溶媒５０を噴出させてカバー部材３０の溶媒供給孔３１を通じて不要膜部分１３ａ（図５参照）に供給してこれを溶解除去するものである。

【００１４】カバー部材３０は、基板１０を上方からかぶせるようにして覆うもので、中心部から周縁にかけての大部分は平坦部３２である。この平坦部３２から外周部に向けて傾斜部３３が形成され、この傾斜部３３からさらに外周部に向けて周縁平坦部３４が形成され、この周縁平坦部３４の外周端が下方に略直角に折り曲げられて、側面部３５が形成されている。

【００１５】周縁平坦部３４には、多数の貫通孔である溶媒供給孔３１が形成されている。この溶媒供給孔３１は、溶媒５０の粘度等に応じて適切な形状、大きさ及び形成間隔が選定される。すなわち、孔形状は正方形、長方形、円形、楕円形、その他いずれでもよい。孔の大きさは、溶媒が一定の供給速度で不要膜部分にむらなく供給される大きさに設定する。また、孔どうしの間隔は、溶媒供給孔３１から供給された溶媒が不要膜全体に隙間なく行き渡らせられる間隔に設定する。

【００１６】この実施例では、孔径を１０．０ｍｍ以下で、溶媒を孔の近辺の不要膜を溶解できる量以上の量だけ通過できる以上の大きさとし、孔どうしの間隔（孔径の外側と外側との間隔）を１０．０ｍｍ以下とした。孔径が小さすぎると、孔の近辺の不要膜を溶解できなくなり、１０ｍｍ以上にすると、除去部分とその他の部分との境界部がギザギザの状態になり易いとともに、カバー部材３０の機械的強度の維持が困難になるからである。また、孔どうしの間隔が小さすぎると、カバー部材３０の機械的強度の維持が困難になるとともに、孔径によっては、溶媒の安定供給ができなくなる場合がある。逆に、孔どうしの間隔を１０．０ｍｍ以上とすると、除去部分とその他の部分との境界部がギザギザの状態になるとともに、除去したい部分を正確に完全に除去することが困難になるからである。

【００１７】また、基板１０の溶媒供給孔３１の適宜の数箇所（例えば４箇所）には、溶媒に耐性のある（例えば、樹脂系）糸６０が通され、カバー部材３０の内壁と基板１０の表面との間に介在されてこれらの間隙の大きさを設定するようになっている。すなわち、この糸６０は、溶媒供給孔３１を通り、周縁平坦部３４の内壁と基板１０の表面との間及び側面部３５の内壁と基板１０の側面との間を通り、さらにカバー部材３０の側面部３５の外側を通過してループ状に形成されている。

【００１８】糸６０の太さは、周縁平坦部３４の内壁と基板１０の表面との間隙の大きさd_1を、この間隙に溶媒を供給したとき溶媒が間隙中をつたわって間隙中に拡がることが可能な大きさに設定する。この実施例では、d_1を０．０５ｍｍ～３ｍｍとする。０．０５ｍｍ以下及び３ｍｍ以上だと溶媒が間隙中をつたわって間隙中に拡がることが困難になり、除去できない部分ができたり、除去部分と他の部分との境界がギザギザ状態になる場合があるからである。

【００１９】また、側面部３５の内壁と基板１０の側面との間隙の大きさd_2は、この間隙中を溶媒が膜に接触しながら通過できる大きさであればよい。d_2の大きさは、d_1と同じにすることが好ましいが、d_1と異ならしめてもよい。異ならしめるときには、図示しないが、例えば、側面部３５に孔を別個に形成して別の太さの糸を用いてその間隙の大きさを規制するようにしてもよい。

【００２０】カバー部材３０の中心部から周縁にかけての大部分である平坦部３２の内壁と対向する基板表面の領域は、必要な膜の領域（不要な膜部分以外の領域）であり、この領域においては、カバー部材３０の内壁と基板１０の表面との間の間隙を、基板表面１０の膜の温度分布がカバー部材３０の内壁面からの熱伝達によって影響を受けないように所定以上大きく、かつ、間隙で気体の対流が生じてこの対流によって基板主表面の膜に温度分布が生じないように所定以下に小さく設定した値であるd_3とする。

【００２１】この実施例では、d_3を０．０５ｍｍ～２０．０ｍｍとする。０．０５ｍｍ以下だとカバー部材か

らの熱伝達を受け易くなり、例えば、カバー部材表面に溶媒の気化熱が不規則に作用して大きな温度分布が生じた場合、その温度分布を直接反映してレジスト膜に温度分布を付与してしまうおそれが高くなる。一方、２０．０ｍｍ以上だと自然の対流が生じて膜に温度分布を生じさせる虞れが高くなる。ただし、この上限の場合は、例えば、強制的に間隙内の気体を均一に撹拌することによって、自然対流による温度分布発生を阻止することも可能であるので、そのような手段を用いた場合には必ずしも規制されるものではない。

【００２２】しかしながら、この間隙を大きくすることは、必然的にカバー部材３０の平坦部３２の高さが高くなることを意味する。平坦部３２の高さが高くなり過ぎると、ノズル４０から供給される溶媒が周辺平坦部３４に至るまでの距離が長くなり、途中で気化する量が増したり、カバー部材及び基板を回転しながら処理する場合には、溶媒が周囲に飛び散るおそれも高くなる。また、装置も大型化するので望ましくない。

【００２３】カバー部材３０を被された基板１０は、回転台２０に保持されて回転されながら処理される。回転台２０は回転軸２１に取り付けられた４本の水平方向に放射状に延びた支持腕２２と、それぞれの支持腕２２の先端部に設けられた一対の保持台座２３とを有する。保持台座２３上に、基板１０の４角を配置して保持するものである。回転軸２１は、図示しない回転駆動装置に結合され、所望の回転数で回転されるようになっている。なお、基板１０の下方にも、溶媒供給用のノズル４０ａが設けられており、該ノズル４０ａから溶媒４０ａを供給して、不要膜除去を確実にすることができるようになっている。

【００２４】上述の装置によって、以下のようにして不要膜を除去する。まず、基板１０を回転台２０にセットしてカバー部材３０を被せたら、ノズル４０から供給量を調節しながら溶媒５０を供給する。同時に、回転台２０を回転数１００～１０００ｒｐｍで１～６０秒間回転させる。これにより、溶媒５０を溶媒供給孔３１を通じて不要膜部分１３ａに浸透させて溶解除去する。さらに、上記処理が終盤に近くなった時点で、ノズル４０ａから溶媒５０ａを噴出させて溶解除去をより確実なものにする。これにより、不要膜部分１３ａが除去される。これにベーク処理等を施してレジスト膜１３が基板の中央部に略正方形状に形成されたレジスト膜付きフォトマスクブランクを得る。

【００２５】こうして得られたフォトマスクブランクのレジスト膜の状態を目視で観察した。その結果、処理中にレジストに温度分布が加えられることに起因するリング状の色ムラがみられず、また、レジスト膜と除去部分との境界線はほぼ直線状であり、除去幅がほぼ一定で正確に除去されていることがわかった。さらに、レジストを顕微鏡で観察したところ、溶媒の飛沫等によるピンホールは全くみられなかった。

【００２６】ここで、上記第１実施例ではレジストを溶解する溶媒として、ＭＣＡ（メチルセロソルブアセテート）を用いたが、これに限られず、レジストを希釈できる溶媒等、不要膜を溶解除去できるものであればどのようなものでもよい。また、上記実施例では間隙設定部材として、樹脂系の糸を用いたが、これは、可撓性を有し、かつ溶媒に対して耐性を有するものであれば他のものでもよい。また、間隙設定部材は、糸状体に限られるものではなく、間隙を設定できるものであればどのようなものでもよく、例えば、カバー部材内壁に設けられた凸状体であってもでもよい。

【００２７】カバー部材を構成する材料としては、熱を伝達しにくく、溶媒に対する耐性を有し、所定の機械的強度を有するものであればどのようなものであてもよい。例えば、樹脂材料、ガラス材料、セラミックス材料及びこれらの複合材料等をあげることができる。なかでも比較的熱伝達しにくく、加工が容易でかつ軽量化が容易な樹脂材料が好ましい。また、カバー部材の少なくとも基板表面の不要な膜部分以外の領域を覆う部分を上記材料で構成することが好ましい。

【００２８】さらに、上記実施例では　遮光性膜パターン上にレジスト膜を形成する場合に適用した例について説明したが、これは、透光性基板上にＳＯＧ膜を形成し、ＳＯＧ膜上に遮光性膜パターンを形成するようにした場合にも適用できる。その場合、遮光膜の外に透明導電膜、エッチングストッパー膜等の膜が設けられたものであってもよい。

【００２９】さらに、例えば、磁気ディスク媒体の保護膜の塗布、カラーフィルターの保護膜の塗布の際に形成される不要膜の除去、あるいは、ディスプレー用基板上の配線の電極部に形成される絶縁膜を除去する場合にも適用できる。 また、例えば、不要膜がレジストの場合は、溶媒としてレジストが可溶なケトン、エステル、芳香族炭化水素、ハロゲン化炭化水素、エーテル等の液体を用いることができる。

【００３０】また、不要膜がＳＯＧの場合は、ベークした後は塗布膜は溶けにくいので、上述の第１実施例のように、ベークする前に基板の裏面、側面及び表面周縁部の塗布膜を溶解して除去することが好ましいが、塗布膜がレジストの場合は、レジストの種類によっては、ベーク後においても溶解可能な場合もある。また、溶媒供給孔３１の設ける位置は、上記実施例に限られるものではない。

【００３１】なお、上記実施例では、基板１０とカバー部材３０とを一体にして回転させる例を掲げたがこれは必ずしも回転させる必要はない。ただし、回転させたほうが溶媒を比較的早くかつ均一に間隙中に拡げさせることができるので好ましい。また、基板１０とカバー部材３０との間の間隙を保つ手段として上記実施例では樹脂

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製の糸を用いたが、これは他の介在部材を用いてもよい。 さらに、カバー部材３０として上記実施例では、正方形状の基板に形成された塗布膜の周縁部を除去して正方形の塗布膜を残存させる例を掲げたが、基板の形状及び残存させる塗布膜の形状は、正方形に限られるものではなく、円形、三角形、多角形その他任意の形状でもよい。その場合には、カバー部材の溶媒供給面と非供給面との形状をそのように形成すればよい。

【００３２】

【発明の効果】以上詳述したように、本発明は、基板表面をカバー部材で覆い、このカバー部材の上から溶媒を供給してこの溶媒をカバー部材の所定部位に設けられた溶媒供給孔を通じて不要な膜部分を溶媒で溶解して除去するとともに、基板表面の不要な膜部分以外の領域においてはカバー部材の内壁と基板表面との間の間隙を、前記カバー部材からの熱伝達による影響により前記基板表面の膜に温度分布が生じない大きさに設定したことを特徴とするもので、これにより、処理中に基板表面に形成された膜に悪影響を及ぼす可能性のある温度分布を与え＊

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＊ることなく不要膜を確実に除去できる不要膜除去方法及びその装置並びにフォトマスクブランク製造方法を得ているものである。

【図面の簡単な説明】

【図１】本発明の第１実施例にかかる不要膜除去装置の断面図である。

【図２】図１の部分拡大断面図である。

【図３】図１の部分拡大断面図である。

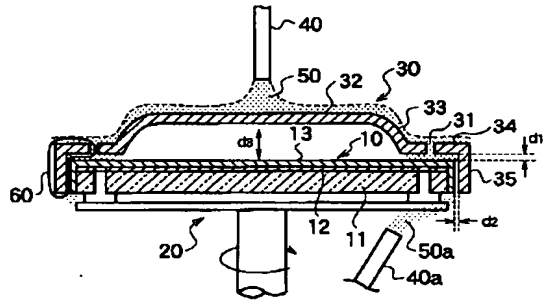
【図４】実施例にかかる不要膜除去装置の部分拡大斜視図である。

【図５】実施例にかかる不要膜除去装置の分解斜視図である。

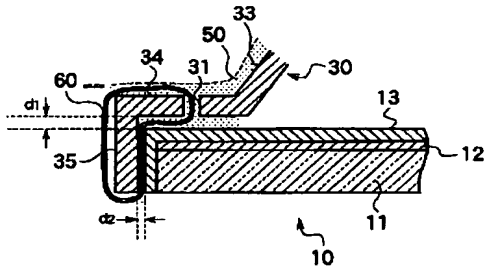
【符号の説明】

１０…基板、１１…透明基板、１２…遮光膜、１３…レジスト膜、２０…回転台、２１…回転軸、２２…保持腕、２３…保持台座、３０…カバー部材、３１…溶媒供給孔、３２…平坦部、３３…傾斜部、３４…周縁平坦部、３５…側面部、４０，４０ａ…ノズル、５０，５０ａ…溶媒。

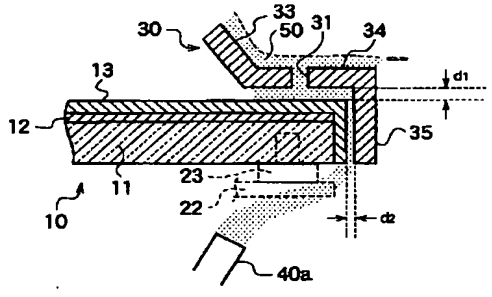
【図１】



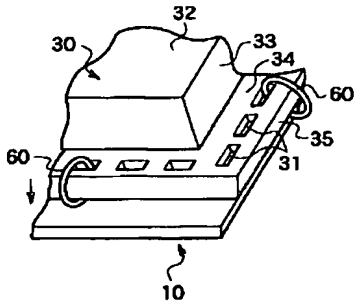
【図２】



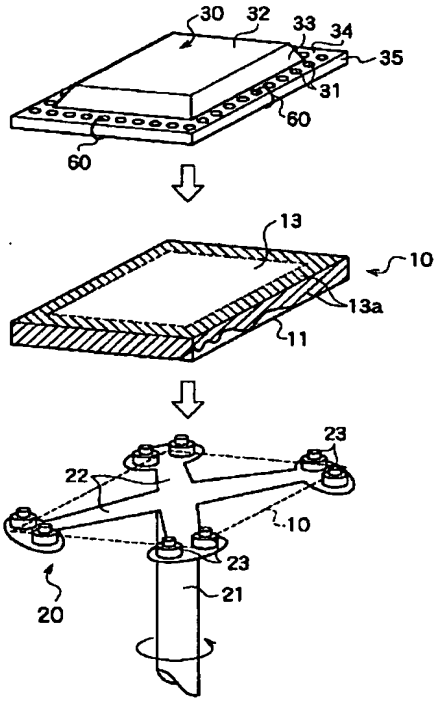
【図３】



【図４】



【図５】



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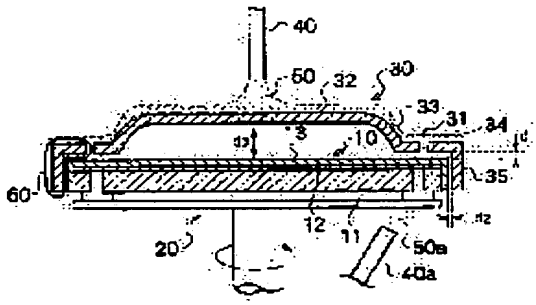
(71)Applicant : HOYA CORP
(72)Inventor : HATA MITSUAKI

(54) METHOD FOR REMOVING UNNECESSARY FILM AND DEVICE THEREFOR, AND METHOD FOR PRODUCING PHOTOMASK BLANK

(57)Abstract:
PROBLEM TO BE SOLVED: To surely remove unnecessary films without giving a temperature distribution which has a detrimental effect on the films formed on the surface of a substrate in the course of treatment.
SOLUTION: There is provided a method for removing unnecessary films, wherein the unnecessary parts of films formed on the surface of the substrate are dissolved and removed by using a solvent. The surface of the substrate 10 is covered with a cover member 30, the unnecessary parts of the films are removed by dissolving them into the solvent 50 fed from the upside of the cover member 30 through a solvent feeding hole 31 installed at the specified position of the cover member 30, and also in the area of the films except the unnecessary parts of the films on the surface of the substrate 10, a gap between the inner wall of the cover member 30 and the surface of the substrate 10 is sized larger than the specified size so that the temperature distribution of the films on the surface of the substrate 10 may not affected by heat transfer from the cover member 30.



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* NOTICES *

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CLAIMS

[Claim(s)]
[Claim 1] It is the unnecessary film clearance approach which carries out dissolution clearance of the unnecessary part of the film formed in the substrate front face with a solvent. While a solvent dissolves and removes an unnecessary film part through the solvent feed holes in which the solvent was supplied for said substrate front face from on a bonnet and this covering member by the covering member, and this solvent was prepared to the predetermined part of a covering member The unnecessary film clearance approach characterized by setting it as the magnitude from which temperature distribution do not produce the gap of Hazama on the wall of said covering member, and said front face of a substrate on the film on said front face of a substrate under the effect by heat transfer from said covering member in fields other than a film part with said unnecessary substrate front face.
[Claim 2] It is the unnecessary film clearance approach which carries out dissolution clearance of the unnecessary part of the film formed in the substrate front face with a solvent. While a solvent dissolves and removes an unnecessary film part through the solvent feed holes in which the solvent was supplied for said substrate front face from on a bonnet and this covering member by the covering member, and this solvent was prepared to the predetermined part of a covering member In fields other than a film part with said unnecessary substrate front face the gap of Hazama on the wall of said covering member, and said front face of a substrate The unnecessary film clearance approach which is the magnitude which temperature distribution do not produce on the film on said front face of a substrate under the effect by heat transfer from said covering member, and is characterized by setting it as the magnitude which the gaseous convection current produces in said gap, and temperature distribution do not produce on the film of a substrate main front face by this convection current.
[Claim 3] The unnecessary film clearance approach according to claim 1 or 2 characterized by fixing magnitude of the gap of Hazama on the wall of said covering member, and said front face of a substrate in fields other than a film part with said unnecessary substrate front face.
[Claim 4] The unnecessary film clearance approach according to claim 1 to 3 characterized by setting it as the magnitude which can be spread by the solvent all over a gap as ****** in the inside of a gap when a solvent is supplied for the gap of Hazama on the wall of said covering member, and said front face of a substrate to this gap in the field of a film part with said unnecessary substrate front face.
[Claim 5] The unnecessary film clearance approach according to claim 1 to 4 characterized by using the string-like object of the predetermined size which intervenes between said covering member walls and said substrate front faces in the field of a film part with said unnecessary substrate front face as a gap setting-out member which sets up the magnitude of the gap of Hazama of said covering member wall and said substrate front face.
[Claim 6] It is characterized by dissolving and removing an unnecessary film part with a solvent through solvent feed holes, rotating both said substrate and a covering member. The unnecessary film clearance approach according to claim 1 to 5.
[Claim 7] In addition to supplying from a covering member, said solvent is the unnecessary film clearance approach according to claim 1 to 6 characterized by making it supply towards the field of an unnecessary film part also from the rear-face side of a substrate.
[Claim 8] It is the unnecessary film stripper which carries out dissolution clearance of the unnecessary part of the film formed in the substrate front face with a solvent. Said substrate front face A wrap covering member, It has the solvent feeder which supplies a solvent from on this covering member. Said covering member It has the solvent feed holes which supply the solvent supplied by said solvent feeder to an unnecessary film part, and carry out dissolution clearance of the unnecessary film. In fields other than a film

part with said unnecessary substrate front face and the gap of Hazama on the wall of said covering member, and said front face of a substrate The unnecessary film stripper which is the magnitude which temperature distribution do not produce on the film on said front face of a substrate under the effect by heat transfer from said covering member, and is characterized by making it the magnitude which the gaseous convection current produces in said gap, and temperature distribution do not produce on the film of a substrate main front face by this convection current.

[Claim 9] The unnecessary film stripper according to claim 8 characterized by fixing magnitude of the gap of Hazama on the wall of said covering member, and said front face of a substrate in fields other than a film part with said unnecessary substrate front face.

[Claim 10] The unnecessary film stripper according to claim 8 or 9 characterized by setting it as the magnitude which can be spread by the solvent all over a gap as ****** in the inside of a gap when a solvent is supplied for the gap of Hazama on the wall of said covering member, and said front face of a substrate to this gap in the field of a film part with said unnecessary substrate front face.

[Claim 11] The photo-mask blank manufacture approach characterized by having the unnecessary film clearance process of removing the unnecessary film formed in the unnecessary part in said film formation process by the approach according to claim 1 to 7 in the photo-mask blank manufacture approach of having the film formation process which forms film, such as a light-shielding film, in a translucency substrate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the manufacture approach of photograph mass BURANKUSU at the unnecessary film clearance approach of removing the unnecessary film formed in a part of substrate front faces, such as for example, a photo-mask blank, a semi-conductor substrate, a magnetic-disk substrate, and a light filter, and its equipment list.
[Description of the Prior Art]
[0002] In the field which manufactures a semiconductor device, a photo mask, a magnetic-disk substrate, a light filter, etc., it is often required that the unnecessary part of the film of the spreading film formed in the 1 main front face of a substrate and others should be removed. For example, in case a resist or the SOG (spin-on glass) film is applied on a substrate When the spin coat method which forms the uniform spreading film on a substrate using the centrifugal force by rotating a substrate, coating liquid being dropped on the substrate held at an abbreviation horizontal is used, If the spreading film makes it rotate at a low speed which is made to form in homogeneity all over a substrate, the centrifugal force committed in the periphery section on the front face of a substrate becomes small, coating liquid will collect on the periphery section on the front face of a substrate, and the thickness of the part will become thick.
[0003] Thus, when the periphery section on the front face of a substrate rises, for example coating liquid is SOG, a crack becomes easy to go into the part. Moreover, although it may have structure which supports the substrate periphery section when SOG attaches in an aligner the phase shift mask currently formed in the periphery section on the front face of a substrate, if the substrate periphery is rising in this case, it will not be held good. Furthermore, when coating liquid is a resist, in case adhesion exposure is performed in piles, the problem that it is not stuck to a photo mask and the resist spreading film good produces a photo mask. Therefore, in such a case, it is necessary to remove the unnecessary spreading film of the substrate surface periphery section.
[0004] As a conventional technique of removing such unnecessary film, there is an approach currently indicated by JP,58-19350,B, JP,6-262124,A, JP,7-20623,A, etc. The approach of the disclosure to JP,58-19350,B lays the front face in a turntable upward, rotates a substrate, arranges covering which was made to inject a solvent by the nozzle from a lower part, or made the pyramid configuration in the air on the substrate front face, supplies a solvent from on the top-most vertices of a pyramid, and supplies it to the periphery section.
[0005] Moreover, the approach of the disclosure to JP,6-262124,A makes a predetermined gap the gap of Hazama of the substrate front face of a part and gap formation member which should supply processing liquid, and processing liquid is certainly supplied to the part. Furthermore, the approach of the disclosure to JP,7-20623,A supplies a gas from the gas inlet established in the covering member, and a solvent prevents trespassing upon a substrate core.
[0006]
[Problem(s) to be Solved by the Invention] In a place, when the film formed for example, in the substrate front face is resist film, some which influence in exposure sensibility sensitively have the temperature hysteresis added to the resist depending on the class of resist film ingredient. In the case of such resist film, when temperature hysteresis changes with membranous locations, exposure sensibility nonuniformity will arise. So, when it processes in an environment which the heat of vaporization of a solvent etc. affects and temperature distribution produce on the resist film when enforcing the above-mentioned unnecessary film clearance approach, exposure sensibility nonuniformity will be given. However, the above-mentioned conventional approach all was not what was not necessarily considered fully to such concern.

[0007] It is made in order that this invention may solve the above-mentioned trouble, and it aims at providing with the photo-mask blank manufacture approach the unnecessary film clearance approach that the unnecessary film is certainly removable, and its equipment list, without giving the temperature distribution which may have an adverse effect on the film formed on the substrate front face during processing.

[0008]

[Means for Solving the Problem] In order to solve an above-mentioned technical problem, the 1st means It is the unnecessary film clearance approach which carries out dissolution clearance of the unnecessary part of the film formed in the substrate front face with a solvent. While a solvent dissolves and removes an unnecessary film part through the solvent feed holes in which the solvent was supplied for said substrate front face from on a bonnet and this covering member by the covering member, and this solvent was prepared to the predetermined part of a covering member It is the unnecessary film clearance approach characterized by setting it as the magnitude from which temperature distribution do not produce the gap of Hazama on the wall of said covering member, and said front face of a substrate on the film on said front face of a substrate under the effect by heat transfer from said covering member in fields other than a film part with said unnecessary substrate front face. The 2nd means is the unnecessary film clearance approach which carries out dissolution clearance of the unnecessary part of the film formed in the substrate front face with a solvent. While a solvent dissolves and removes an unnecessary film part through the solvent feed holes in which the solvent was supplied for said substrate front face from on a bonnet and this covering member by the covering member, and this solvent was prepared to the predetermined part of a covering member In fields other than a film part with said unnecessary substrate front face the gap of Hazama on the wall of said covering member, and said front face of a substrate It is the magnitude which temperature distribution do not produce on the film on said front face of a substrate under the effect by heat transfer from said covering member, and is the unnecessary film clearance approach characterized by setting it as the magnitude which the gaseous convection current produces in said gap, and temperature distribution do not produce on the film of a substrate main front face by this convection current. The 3rd means is the unnecessary film clearance approach concerning the 1st or 2nd means characterized by fixing magnitude of the gap of Hazama on the wall of said covering member, and said front face of a substrate in fields other than a film part with said unnecessary substrate front face. The 4th means is the unnecessary film clearance approach which requires a solvent for the 1st thru/or the 3rd means characterized by setting the inside of a gap as the magnitude which can be spread all over a gap as ******, when a solvent is supplied for the gap of Hazama on the wall of said covering member, and said front face of a substrate to this gap in the field of a film part with said unnecessary substrate front face. The 5th means is the unnecessary film clearance approach concerning the 1st characterized by using the string-like object of the predetermined size which intervenes between said covering member walls and said substrate front faces as a gap setting-out member which sets up the magnitude of the gap of Hazama of said covering member wall and said substrate front face thru/or the 4th one of means in the field of a film part with said unnecessary substrate front face. The 6th means is characterized [both] by dissolving and removing an unnecessary film part with a solvent through solvent feed holes, rotating said substrate and a covering member. It is the unnecessary film clearance approach concerning the 1st thru/or the 5th one of means. the 7th means supplies said solvent from a covering member -- in addition, it is the unnecessary film clearance approach concerning the 1st characterized by making it supply towards the field of an unnecessary film part also from the rear-face side of a substrate thru/or the 6th one of means. The 8th means is an unnecessary film stripper which carries out dissolution clearance of the unnecessary part of the film formed in the substrate front face with a solvent. Said substrate front face A wrap covering member, It has the solvent feeder which supplies a solvent from on this covering member. Said covering member It has the solvent feed holes which supply the solvent supplied by said solvent feeder to an unnecessary film part, and carry out dissolution clearance of the unnecessary film. In fields other than a film part with said unnecessary substrate front face and the gap of Hazama on the wall of said covering member, and said front face of a substrate It is the magnitude which temperature distribution do not produce on the film on said front face of a substrate under the effect by heat transfer from said covering member, and is the unnecessary film stripper characterized by making it the magnitude which the gaseous convection current produces in said gap, and temperature distribution do not produce on the film of a substrate main front face by this convection current. The 9th means is an unnecessary film stripper concerning the 7th means characterized by fixing magnitude of the gap of Hazama on the wall of said covering member, and said front face of a substrate in fields other than a film part with said unnecessary substrate front face. The 10th means is an unnecessary film stripper which requires a solvent for the 8th or

9th means characterized by setting the inside of a gap as the magnitude which can be spread all over a gap as ******, when a solvent is supplied for the gap of Hazama on the wall of said covering member, and said front face of a substrate to this gap in the field of a film part with said unnecessary substrate front face. The 11th means is the photo-mask blank manufacture approach characterized by having the unnecessary film clearance process of removing the unnecessary film formed in the unnecessary part in said film formation process by the approach concerning the 1st thru/or the 7th one of means in the photo-mask blank manufacture approach of having the film formation process which forms film, such as a light-shielding film, in a translucency substrate.

[0009] According to the 1st above-mentioned means, it sets to fields other than a film part with an unnecessary substrate front face (not only the main front face but a side face and a rear face are included). The gap of Hazama on the wall of said covering member, and said front face of a substrate The unnecessary film can be removed by having set it as the magnitude which temperature distribution do not produce on the film on said front face of a substrate under the effect by heat transfer from said covering member, without giving the temperature distribution which may have an adverse effect on the film by heat transfer from the covering member formed on the substrate front face during processing. Moreover, even if the heat of vaporization of a solvent etc. acts on a covering member front face at an ununiformity and temperature distribution arise by this, a possibility [like] that the effect may attain to the film on the front face of a substrate, and may give temperature nonuniformity to the film can also be prevented. It follows, for example, also when heat treatment hysteresis is different for every location and the above-mentioned film is resist film which sensibility nonuniformity produces, a possibility of giving harmful sensibility nonuniformity can be prevented effectively. Furthermore, needs, such as using the member which carried out special consideration for making it surface temperature nonuniformity not reach a wall as a covering member, can also be abolished. According to the 2nd means, it sets to fields other than a film part with an unnecessary substrate front face. The gap of Hazama on the wall of said covering member, and said front face of a substrate It is the magnitude which temperature distribution do not produce on the film on said front face of a substrate under the effect by heat transfer from said covering member. And the unnecessary film is removable by having set it as the magnitude which the gaseous convection current produces in said gap, and temperature distribution do not produce on the film of a substrate main front face by this convection current, preventing more effectively the possibility of the temperature-distribution grant which may have an adverse effect on the film formed on the substrate front face during processing. According to the 3rd means, the unnecessary film is removable by having fixed magnitude of the gap of Hazama on the wall of said covering member, and said front face of a substrate in fields other than a film part with an unnecessary substrate front face, preventing still more effectively the possibility of the temperature-distribution grant which may have an adverse effect on the film formed on the substrate front face during processing. According to the 4th means, it sets to the field of a film part with said unnecessary substrate front face. The gap of Hazama on the wall of said covering member, and said front face of a substrate By having set it as the magnitude which can be spread by the solvent all over a gap as ****** in the inside of a gap according to an operation of that surface tension etc. when a solvent is supplied to this gap For example, that it becomes possible to make the width of face of a periphery flat part itself into clearance width of face etc. supplies the solvent supplied from solvent feed holes to a positive and film part unnecessary to accuracy, and this can be removed. According to the 5th means, it sets to the field of a film part with said unnecessary substrate front face. By having used the string-like object of the predetermined size which intervenes between said covering member walls and said substrate front faces as a gap setting-out member which sets up the magnitude of the gap of Hazama of said covering member wall and said substrate front face The gap of predetermined magnitude can be formed very easily, without forming special equipment etc., in order to circulate a solvent all over a gap. Rotating both said substrate and a covering member, by dissolving with a solvent and having removed the unnecessary film part through solvent feed holes, using an operation of a centrifugal force etc., a solvent can be opened uniformly and, according to the 6th means, a easier and certainly unnecessary film part can be supplied. According to the 7th means, it becomes possible by having supplied the solvent towards the field of an unnecessary film part also from the rear-face side of a substrate in addition to supplying from a covering member to remove the unnecessary film more certainly. In addition, coincidence is sufficient, and the timing supplied from a rear-face side may be the back, or even when it is intermittent, it is good [the point is sufficient to the timing of the solvent supply supplied from a covering member, and]. According to the 8th means, the equipment which can enforce the approach concerning the 1st and 2nd means can be obtained. According to the 9th means, the unnecessary film is removable by having fixed magnitude of the gap of Hazama on the wall of said covering member, and said

front face of a substrate in fields other than a film part with an unnecessary substrate front face, preventing still more effectively the possibility of the temperature-distribution grant which may have an adverse effect on the film formed on the substrate front face during processing. According to the 10th means, the equipment from which an unnecessary film part to remove is more removable to accuracy can be obtained. According to the 11th means, the photo-mask blank manufacture approach that the unnecessary film is certainly [correctly easily and] removable can be acquired.

[0010]

[Embodiment of the Invention] The partial amplification perspective view of the unnecessary film stripper which the sectional view, drawing 2 , and drawing 3 which show the configuration of the unnecessary film stripper which drawing 1 requires for the example of this invention require for the partial expanded sectional view of drawing 1 , and drawing 4 requires for an example, and drawing 5 are the decomposition perspective views of the unnecessary film stripper concerning an example. Hereafter, the photo-mask blank manufacture approach is explained to the unnecessary film clearance approach concerning an example, and its equipment list, making these drawings reference. The following explanation explains first the photo-mask blank in which the unnecessary film was formed, next explains the configuration of an unnecessary film stripper, finally it combines with the unnecessary film clearance approach, and the photo-mask blank manufacture approach is explained by it.

[0011] In drawing 1 thru/or drawing 5 , a substrate 10 is the photo-mask (refer to drawing 3 and drawing 4) blank by which the light-shielding film 12 which consists of chromium was formed in the front face of the transparence substrate (6 inch x6 inch x0.25 inch) 11 which consists of synthetic quartz glass, and the resist film (PBSC by Chisso Corp.) 13 of the condition of non-BEKU with a thickness of 4000A was further formed with the spin coat method etc. on this light-shielding film 12.

[0012] Here, this resist film 13 should be essentially formed only in the body of the front face of a substrate 11. However, it will be formed even in the substrate rear-face section depending on the periphery section of the front face of the substrate 11 which does not have the need of originally forming, in the case of formation of the resist film 13, a substrate lateral portion, and the case. The unnecessary film clearance approach concerning this example and its equipment are the approaches and equipment from which these unnecessary film is removed.

[0013] As shown in drawing 1 , the unnecessary film stripper of this example gushes the solvents 50, such as MCA (methyl-cellosolve acetate), from a nozzle 40 from the upper part of a bonnet and this covering member 30 by the covering member 30, supplies the top-face side of the substrate 10 by which installation maintenance was carried out on the revolution base 20 to unnecessary film partial 13a (refer to drawing 5) through the solvent feed holes 31 of the covering member 30, and carries out dissolution clearance of this.

[0014] Most which it is a wrap thing as the covering member 30 puts a substrate 10 from the upper part, and is applied to a periphery from a core is a flat part 32. A ramp 33 is formed towards the periphery section from this flat part 32, the periphery flat part 34 is further formed towards the periphery section from this ramp 33, the periphery edge of this periphery flat part 34 is caudad bent by the abbreviation right angle, and the lateral portion 35 is formed.

[0015] The solvent feed holes 31 which are many breakthroughs are formed in the periphery flat part 34. According to the viscosity of a solvent 50 etc., as for these solvent feed holes 31, a suitable configuration, magnitude, and formation spacing are selected. namely, a hole -- a square, a rectangle, circular, an ellipse form, and other any are sufficient as a configuration. The magnitude of a hole is set as the magnitude by which a solvent is uniformly supplied to an unnecessary film part with a fixed speed of supply. moreover, a hole -- spacing of comrades is set as spacing which the solvent supplied from the solvent feed holes 31 spreads that there is no clearance in the whole unnecessary film.

[0016] the above magnitude which can pass only the amount more than the amount which can dissolve [an aperture] the neighboring unnecessary film of a hole for a solvent by 10.0mm or less in this example -- carrying out -- a hole -- spacing (spacing of the outside of an aperture and an outside) of comrades was set to 10.0mm or less. If it becomes impossible to dissolve the neighboring unnecessary film of a hole when an aperture is too small, and it is made 10mm or more, while the boundary section of a clearance part and other parts will tend to be in a notched condition, it is because maintenance of the mechanical strength of the covering member 30 becomes difficult. moreover, a hole -- if spacing of comrades is too small, while maintenance of the mechanical strength of the covering member 30 will become difficult, there is a case where adequate supply of a solvent becomes impossible depending on an aperture. It is because it becomes difficult to remove a part to remove thoroughly conversely at accuracy while the boundary section of a clearance part and other parts will be in a notched condition, if spacing of holes is set to 10.0mm or more.

[0017] Moreover, it lets the yarn 60 which has resistance in a solvent (for example, resin system) pass, it intervenes between the wall of the covering member 30, and the front face of a substrate 10, and the magnitude of these gaps is set as several proper places (for example, four places) of the solvent feed holes 31 of a substrate 10. namely, this yarn 60 -- the solvent feed holes 31 -- a passage -- between the wall of the periphery flat part 34, and the front faces of a substrate 10, and between the wall of a lateral portion 35, and the side faces of a substrate 10 -- a passage -- further -- the covering member 30 -- it passes through the outside of a lateral portion 35, and is formed in the shape of a loop formation.
[0018] The size of yarn 60 is set as the magnitude which can be spread by the solvent all over a gap as ****** in the inside of a gap, when a solvent is supplied for the magnitude d1 of the gap of the wall of the periphery flat part 34, and the front face of a substrate 10 to this gap. d1 is set to 0.05mm - 3mm in this example. It is because it may become difficult for a solvent to spread the inside of a gap all over a gap as ******, and an unremovable part may be made or the boundary of a clearance part and other parts may be in a notched condition, if it is 0.05mm or less and 3mm or more.
[0019] Moreover, the magnitude d2 of the gap of the wall of a lateral portion 35 and the side face of a substrate 10 should just be the magnitude which can pass through the inside of this gap while a solvent contacts the film. Although it is desirable to make it the same as d1 as for the magnitude of d2, it may be made to differ from d1. Although it does not illustrate when you make it differ, a hole is separately formed in a lateral portion 35, and you may make it regulate the magnitude of the gap for example, using the yarn of another size.
[0020] The wall of the flat part 32 which is most which lasts to a periphery from the core of the covering member 30, and the field on the front face of a substrate which counters Are the field (fields other than an unnecessary film part) of the required film, and it sets to this field. Are large more than predetermined so that the temperature distribution of the film on the front face 10 of a substrate may not be influenced for the gap of Hazama of the wall of the covering member 30, and the front face of a substrate 10 by heat transfer from the internal surface of the covering member 30. And it is referred to as d3 which is the value small set to below predetermined so that the gaseous convection current might arise in a gap and temperature distribution might not arise on the film of a substrate main front face by this convection current.
[0021] d3 is set to 0.05mm - 20.0mm in this example. When it was 0.05mm or less, and it becomes easy to receive heat transfer from a covering member, for example, the heat of vaporization of a solvent acts on a covering member front face irregularly and big temperature distribution arise, a possibility of giving temperature distribution to the resist film directly reflecting the temperature distribution becomes high. On the other hand, if it is 20.0mm or more, a possibility of the natural convection current arising and making the film producing temperature distribution will become high. However, since it is also possible to prevent temperature-distribution generating by the free convection by agitating the gas in a gap to homogeneity compulsorily when it is this upper limit for example, when such a means is used, it is not necessarily regulated.
[0022] However, enlarging this gap means that the height of the flat part 32 of the covering member 30 becomes high inevitably. In processing rotating [if the height of a flat part 32 becomes high too much the amount which distance until the solvent supplied from a nozzle 40 results in the circumference flat part 34 becomes long, and evaporates on the way will increase, or] a covering member and a substrate, a possibility that a solvent may scatter around also becomes high. Moreover, since equipment is also enlarged, it is not desirable.
[0023] hang the covering member 30 -- ****** 10 is processed, being held on the revolution base 20 and rotating. The revolution base 20 has the maintenance plinth 23 of the couple prepared in horizontally [four] it attached in the revolving shaft 21 at the point of the support arm 22 prolonged in the radial, and each support arm 22. Four angles of a substrate 10 are arranged and held on the maintenance plinth 23. It is combined with the revolution driving gear which is not illustrated, and a revolving shaft 21 rotates at a desired rotational frequency. In addition, also under the substrate 10, nozzle 40a for solvent supply is prepared, this nozzle 40a to solvent 40a can be supplied, and unnecessary film clearance can be ensured now.
[0024] Above-mentioned equipment removes the unnecessary film as follows. First, if a substrate 10 is set to the revolution base 20 and the covering member 30 is put, a solvent 50 will be supplied, adjusting the amount of supply from a nozzle 40. Simultaneously, the revolution base 20 is rotated for 1 - 60 seconds by the rotational frequency 100 - 1000rpm. Thereby, a solvent 50 is made to permeate unnecessary film partial 13a through the solvent feed holes 31, and dissolution clearance is carried out. Furthermore, when the above-mentioned processing becomes near in the end, nozzle 40a to solvent 50a is gushed, and dissolution

clearance is made into a more positive thing. Thereby, unnecessary film partial 13a is removed. The photo-mask blank with the resist film which performs BEKU processing etc. to this and by which the resist film 13 was formed in the center section of a substrate at the abbreviation square configuration is obtained.
[0025] In this way, the condition of the resist film of the obtained photo-mask blank was observed visually. Consequently, the color nonuniformity of the shape of a ring resulting from temperature distribution being added during processing at a resist was not seen, and the borderline of the resist film and a clearance part was a straight line-like mostly, and clearance width of face was almost fixed, and it turned out that it is removed by accuracy. Furthermore, when the resist was observed under the microscope, the pinhole by the droplet of a solvent etc. was not seen at all.
[0026] Although MCA (methyl-cellosolve acetate) was used in the 1st example of the above here as a solvent which dissolves a resist, as long as it can carry out the dissolution clearance of the unnecessary film, such as a solvent which is not restricted to this but can dilute a resist, what kind of thing may be used. Moreover, although the yarn of a resin system was used as a gap setting-out member in the above-mentioned example, as long as this has flexibility and has resistance to a solvent, other things are sufficient as it. Moreover, if a gap setting-out member is not restricted to a filament and a gap can be set up, even if it will be the convex object which what kind of thing is sufficient as, for example, was prepared in the covering member wall, it is [but] good.
[0027] If it is hard to transmit heat, it has the resistance over a solvent as an ingredient which constitutes a covering member and it has a predetermined mechanical strength, it is what kind of thing and reliance is also good. For example, a resin ingredient, a glass ingredient, ceramic ingredients, such composite material, etc. can be raised. Especially, it is comparatively hard to heat-transfer and a resin ingredient with easy lightweight-izing with easy and processing is desirable. Moreover, it is desirable to constitute a wrap part for fields other than the film part with a substrate front face unnecessary at least of a covering member from an above-mentioned ingredient.
[0028] Furthermore, it is at the above-mentioned example. Although the example applied when the resist film was formed on a shading film pattern was explained, this can be applied, also when the SOG film is formed on a translucency substrate and a shading film pattern is formed on the SOG film. In that case, film, such as transparence electric conduction film and etching stopper film, may be prepared out of a light-shielding film.
[0029] Furthermore, also when removing the insulator layer formed in the polar zone of clearance of the unnecessary film formed in the case of spreading of the protective coat of a magnetic-disk medium, and spreading of the protective coat of a light filter, or wiring on the substrate for a display, for example, it can apply. Moreover, for example, when the unnecessary film is a resist, a resist can use liquids, such as a meltable ketone, ester, aromatic hydrocarbon, halogenated hydrocarbon, and the ether, as a solvent.
[0030] Moreover, like the 1st above-mentioned example, since the spreading film cannot melt easily after BEKU when the unnecessary film is SOG, when the spreading film is a resist although it is desirable to dissolve and remove the spreading film of the rear face of a substrate, a side face, and the surface periphery section before BEKU, depending on the class of resist, it may be able to dissolve after BEKU. Moreover, the location which the solvent feed holes 31 prepare is not restricted to the above-mentioned example.
[0031] In addition, although the example rotate one by carrying out a substrate 10 and the covering member 30 was hung up, this does not need to make it not necessarily rotate in the above-mentioned example. However, since the rotated way can make early and homogeneity open a solvent all over a gap comparatively, it is desirable. Moreover, although the yarn made of resin was used in the above-mentioned example as a means which maintains the gap of Hazama of a substrate 10 and the covering member 30, this may use other inclusion members. Furthermore, although the example which the periphery section of the spreading film formed in the square-like substrate is removed [example], and makes the square spreading film remain was hung up in the above-mentioned example as a covering member 30, the configuration of a substrate and the configuration of the spreading film made to remain may not be restricted to a square, and the configuration of circular, a triangle, and other arbitration [a polygon and] is sufficient as it. In that case, what is necessary is just to form the configuration of the solvent supply side of a covering member, and a non-supplying field such.
[0032]
[Effect of the Invention] As explained in full detail above, while a solvent dissolves and removes an unnecessary film part through the solvent feed holes in which this invention supplied the solvent for the substrate front face from on a bonnet and this covering member by the covering member, and this solvent was prepared to the predetermined part of a covering member It is what is characterized by setting it as the

magnitude from which temperature distribution do not produce the gap of Hazama on the wall of a covering member, and the front face of a substrate on the film on said front face of a substrate under the effect by heat transfer from said covering member in fields other than a film part with an unnecessary substrate front face. The photo-mask blank manufacture approach has been acquired in the unnecessary film clearance approach that the unnecessary film is certainly removable, and its equipment list, without giving the temperature distribution which may have an adverse effect on the film formed on the substrate front face during processing by this.

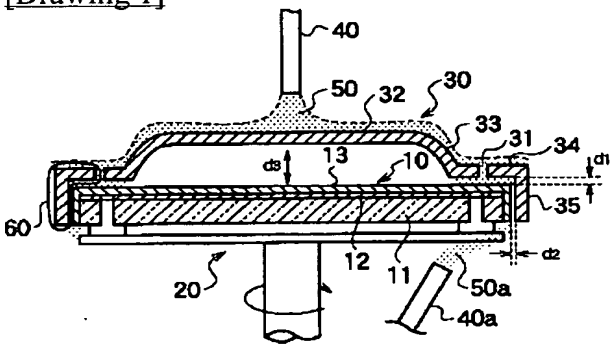
[Translation done.]

* NOTICES *

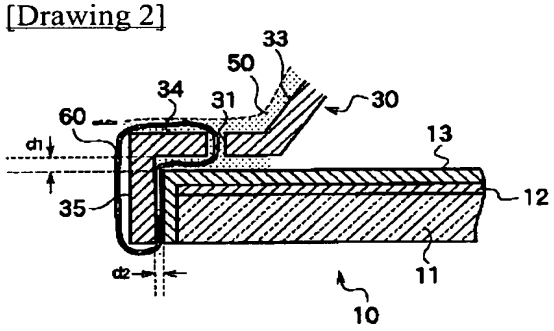
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

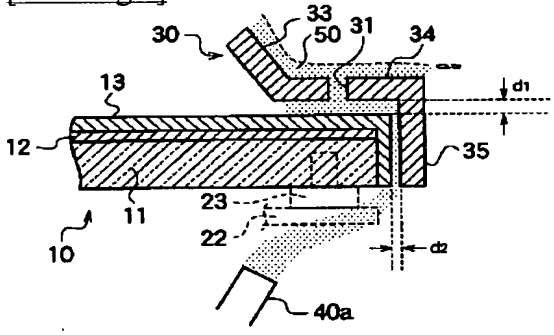
[Drawing 1]



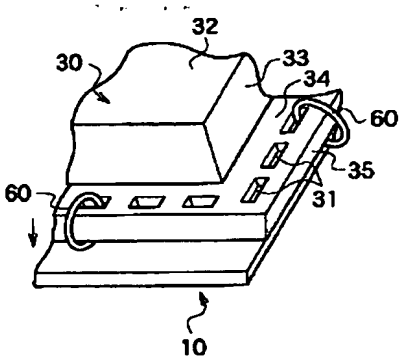
[Drawing 2]



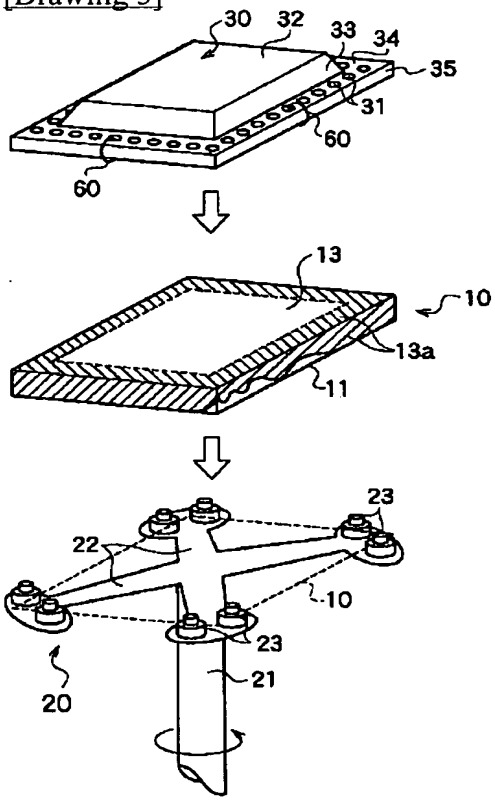
[Drawing 3]



[Drawing 4]



[Drawing 5]



[Translation done.]